Subject to Revision.

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THE MANUFACTURE OF IRON IN CANADA.

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I.

THE MANUFACTURE OF IRON IN THE PROVINCE OF QUEBEC.

The St. Maurice Forges.—The deposits of iron-ore in the St. Maurice district, in the rear of Three Rivers, were probably known to the Indians and Jesuits, but it is not till 1667 that any discovery is reported. The affairs of the colony were then in the control of the "West India Company," who amongst other monopolies had a right to all mines and minerals.* Specimens of the iron-ore were examined in Quebec in 1668 by the Sieur la Potardière, who reported unfavorably on them.

In 1671, Louis de Buade, Comte de Frontenac, was appointed governor of La Nouvelle France; and in the original manuscripts relating to his administration some allusion is occasionally found to the St. Maurice iron mines.† In a letter to the Imperial Government, dated 2d November, 1672, he says:

"The iron mine of which I have already spoken is of great consequence. I have visited it myself, in order that I may be enabled to give a more accurate account of its nature. I am gratified to learn that another mine has been discovered in Champlain, which is much richer than the Cap de la Madelaine mine, and the ore is in greater abundance. I apprehend that it will be next to impossible to exhaust this mine, as there is an extent of country of four leagues in length from Cap de la Madelaine to Champlain, which is covered with iron ore; all the streams indicate its existence. I had the curiosity to taste the water, and I found it all strongly impregnated with rust and iron, but the miners whom I sent there render the affair certain; they are now working there and if you have any intention of establishing forges and a foundry, you may be certain that the material

* Smith's *Canada*, 1851—vol. 1, p. xlvii.

† *British and Canadian Review*, by Macaulay.

will not be wanting. There are six piles of ore, now lying at Cap de la Madelaine which, according to the annexed report of the miner, would last for two castings a day for four months. The important question is the placing of the forges. According to my opinion I should prefer building them on Ruisseau Pepin, which is in Champlain, rather than at the Cape, where the Jesuit fathers have a mill already in operation. By thus placing the forges they would be between the two mines, and the material could be more easily conveyed from both to the central establishment. When you have decided upon establishing the said forges, as the workmen you will send out will be competent men, they perhaps can decide whether there is enough water in the stream I have above mentioned to work the wheel of the projected forges, also to judge whether it would not be practicable to bring in other streams in the neighborhood, such as Ruisseau d'Hertel, to increase the quantity of water. The chief miner, who is now here, assures me that this can be easily and successfully done. It is certain that if the forges are once established many advantages will result to the colony; excellent iron will be manfactured there, and the consumption of fuel will help materially in the clearing of the forest land. Moreover many men will be employed at the work and a market will thus be afforded for the surplus provisions which we have at our disposal."

The West India Company surrendered its charter in 1675, and on the 4th of August, 1676, the first deed in connection with the forges appears, as the original concession of the Seigneurie of St. Maurice was made on that date to Dame Jeanne Jalope, widow of Maurice Poulin, Sieur de la Fontaine, King's Attorney for Three Rivers, by the Intendant, M. Talon.

On the 19th January, 1683, Dame Jalope gave the property to her son, Michel Poulin; but the other children evidently had some claims upon it, as on the 30th of April, 1683, there is a discharge recorded from Jean Baptiste Paulin de Corval, one of the brothers, and on the 20th November, 1690, a discharge was registered from François le Maitre de la Movill, who married a sister.

In 1681, an extract from a letter, by the Count de Frontenac, reads as follows:

"I am convinced that there is a very fine iron-mine in the vicinity of Three Rivers, where a forge could be profitably worked. I wish I had a man here who could plan the construction of an establishment of that kind; it would be of great use to His Majesty the King and to the whole colony. Monsieur Vallon can inform you, my lord, how

Mons. de Colbert has tested the quality of the ore and with favorable results. I have sent a small quantity to Mons. Arnoul, who can give you an account of it. There is a large stream in the vicinity of this mine."

In 1685 the Marquis of Denonville was appointed governor, and on the 18th of November, the following year, in a despatch to the government of France, he says:

"I have this year again had the iron-mine near Three Rivers thoroughly examined. I am convinced that there is a much larger quantity of that metal than the colony requires. The great desideratum is the discovery of a stream or water-power, which can be used in winter, and it is in this respect that we require an able experienced man, who could see what could be done for the establishment. Last year I sent a sample of this iron to France, and the iron-workers, who found it of good quality and percentage, wish to have fifteen or twenty bariques to give it a thorough trial as to quality; it would be well to satisfy them on this point next year. If our Northern Company should succeed there would be no difficulty in accomplishing this desirable object."

On the 4th of April, 1725, Pierre Poulin made "Foi et Hommage"* in the castle of St. Louis in Quebec for himself, and also on his brother's account, for the *fief* and *seigneurie* of St. Maurice and on the following day "L'aveu and Denombrement" of the seigneurie was made.

The mining rights and minerals do not seem to have been granted with the land; for King Louis XIV., on March 22d, 1730, granted a license to a M. Francheville to work the mines, and a partnership was entered into by him with Peter Poulin, Gamelin and Cugnet, for this purpose, the deed of partnership being dated the 16th of June, 1733. It seems probable that a forge was now built, but the enterprise did not prove a success; the principal, Francheville, having died, his widow and the other partners, on the 23d of October, 1735, surrendered their rights to the crown.

The iron-ore was a bog-ore, the deposits being on the surface, or only a few inches below the soil, so that the work of collecting the ore was more digging than mining, and it was necessary to have access to a considerable area of land. We find that on the 15th of October, 1736, Poulin, Louise de Boulanger his wife, and Michel Poulin his brother, a priest, sold the *fief* and *seigneurie* St. Maurice,

* See Parkman's *Old Regime*, p. 246, also Lemoine's *Quebec Past and Present*, p. 121, for a description of "Foi et Hommage."

to François Etienne Cugnet, Pierre François Taschereau, Olivier de Vezain, Jacques Simonet, and Ignace Gamelin for 6,000 livres, with no terms, so long as they paid 300 livres a year.

The partners above named were called Cugnet and Cie., or "La Compagnie des Forges," and the King of France, now Louis XV, by an order-in-council dated April 22d, 1737, empowered them to erect iron works and for this purpose advanced them 100,000 livres and claimed no rents or dues. They accordingly in that year built a blast furnace, and on the 12th of September obtained a concession of some more land, called the *fief* St. Etienne, from M. Hocquart, who was Intendant at that time. In two years' time, a French artisan was procured who improved the works and methods of working; but it was all in vain, a want of capital being said to have been the cause of failure. The Company could not carry on the works, but had to give them up, and, on the 1st of May, 1743, the Crown took possession, whereon they were worked on the King's account and in his name.

"Skilled workmen were sent out from France, who rebuilt, in part at least, the blast-furnace as it now stands, and erected a Walloon hearth which is still in use for refining."* Extensions and additions were made, and the place in six years' time, had assumed very considerable proportions, as the following account will show.

On August 3d, 1749, Professor Peter Kalm, Professor of Economy in the University of Aobo in Swedish Finland, and member of the Swedish Royal Academy of Sciences, stopped at Three Rivers in his travels through the country, for the special purpose of seeing the iron-works. He thus describes his visit:†

"Whilst my company was resting, I went on horseback to view the iron-work. The country which I passed through was pretty high, sandy and generally flat. I saw neither stones nor mountains here. The iron-work, which is the only one in this country, lies three miles to the west of Trois Rivières. Here are two great forges, besides two lesser ones to each of the great ones and under the same roof with them. The bellows were made of wood, and everything else, as it is in Swedish forges. The melting-ovens stand close to the forges and are the same as ours. The ore is got two French miles and a half from the iron-works and is carried thither on sledges. It is a kind of moor-ore, which lies in veins within six

* Dr. T. Sterry Hunt, in Swank's *Iron in all Ages*, 1884.

† *Travels into North America*, by Peter Kalm, London, 1771—vol. iii, p. 87.

inches or a foot from the surface of the ground. Each vein is from six to eighteen inches deep, and below is a white sand. The veins are surrounded with this sand on both sides, and covered on the top with a thin mould. The ore is pretty rich and lies in loose lumps in the veins, of the size of two fists, though there are a few which are near eighteen inches thick. These lumps are full of holes which are full of ochre. The ore is so soft that it may be crushed betwixt the fingers. They make use of a gray limestone which is broke in the neighborhood for promoting the fusibility of the ore; to this purpose they likewise employ a clay marl, which is found near this place. Charcoals are to be had in great abundance here, because all the country round this place is covered with woods, which have never been stirred. The charcoal from evergreen trees, that is, from the fir kind, are best for the forge, but those of deciduous trees are best for the smelting-oven. The iron which is here made is described to me as soft, pliable and tough, and is said to have the quality of not being attacked by rust so easily as other iron; and in this point there appears a great difference between the Spanish iron and this in ship-building. This iron-work was first founded in 1737 by private persons, who afterwards ceded it to the King; they cast cannons and mortars here of different sizes, iron stoves which are in use all over Canada, kettles, etc., not to mention the bars which are made here. They have likewise tried to make steel here, but cannot bring it to any great perfection, because they are unaquainted with the best manner of preparing it. Here are many officers and overseers, who have very good houses built on purpose for them. It is agreed on all hands that the revenues of the iron-work do not pay the expenses, which the King must every year be at in maintaining it. They lay the fault on the bad state of population, and say that the few inhabitants in the country have enough to do with agriculture, and that it therefore costs great trouble and large sums to get a sufficient number of workmen. But, however plausible this may appear, yet it is surprising that the King should be a loser in carrying on this work, for the ore is easily broken, very near the iron-work and very fusible. The iron is good and can be very conveniently dispersed over the country. This is, moreover, the only iron-work in the country, from which everybody must supply himself with iron tools, and what other iron he wants. But the officers and servants belonging to the iron-work appear to be in very affluent circumstances. A river runs down from the iron-work into the river St. Lawrence by which all the iron can be sent in boats

through the country at a low rate. In the evening I returned again to Trois Rivières."

There evidently was very good ground for Kalm's suspicions, as the peculations of the Governor, Intendant, and principal officials were at this time notorious, and "complaint after complaint was despatched to France touching the ruinous state of things they were fast producing in the Province."*

The Governor, the Marquis de la Jonquière, was recalled, but died in Quebec, in May, 1752. In that year an inspector, M. Franquet, was sent to visit the different posts in La Nouvelle France, and the following is a translation of a portion of a French manuscript account of his visit to the forges:†

"M. Bigot, Intendant of New France, who resides at Quebec, had recommended me to visit the St. Maurice forges, as the establishment was extensive, and as he had no doubt that I would be pleased to be in a position to give an account of it. By stopping at Three Rivers, I could reach the forges in two hours, so having settled upon that course, I requested M. Rigaud, who was then in charge of that post, to accompany me. We left Three Rivers at 5 o'clock A.M., with M. Tonnancour and other friends, whom M. Rouville, director of the forges, had invited to accompany us. In leaving the town, we ascended a hill covered with sand, crossed a plain, and passed through a wood of stunted trees, on emerging from which we stood on a hill overlooking a valley, in which the said forges of the king are situated; we crossed a wooden bridge built over a small stream, and disembarked from our conveyance at the door of the Director's dwelling. After the first ceremony of reception by the Director, his wife, and the other employés, we proceeded to visit the works. The stream which drives the machinery is dammed up in three places; the first dam drives the wheel for the furnace, the second and third each a trip-hammer. Each dam has a water-pass to prevent overflow in high water; it is supposed that the stream or water-power is sufficiently strong to drive two other hammers. The buildings of the post are irregularly situated on the banks of a stream, and little or no taste seems to have been displayed in placing them. The principal building is the Director's residence, a very large establishment, but scarcely large enough for the number of employés who have to be accommodated.

"On entering the forge, I was received with a customary cere-

* McMullin's *Canada*, 1855, p. 106.

† Macaulay in *British and Canadian Review*.

mony ; the workmen moulded a pig of iron about 15 feet long, for my special benefit. The process is very simple, it is done by plunging a large ladle into the liquid boiling ore and emptying the material into a gutter made in the sand. After this ceremony I was shown the process of stove-moulding, which is a very simple affair, but rather an intricate operation ; each stove is in six pieces, which are separately moulded, they are (afterwards) fitted into each other, and form a stove above three feet high. I then visited the shed where the workmen were moulding pots, kettles, and other hollow-ware. On leaving this part of the forge we were taken to the hammer forges, where bar iron of every kind is hammered out. In each department of the forges, the workmen observed the old ceremony of brushing a stranger's boots ; in return they expect some money to buy liquor to drink to the visitor's health. This establishment is very extensive, employing upwards of 180 men. Nothing is consumed in the furnace but charcoal, which is made in the immediate vicinity of the post. The ore is rich, good, and tolerably clean ; it formerly was found on the spot, now the Director has to send some distance for it. The management of these forges is economical. It must be readily understood, that owing to the numerous branches in which expenditure must be incurred, unless a competent man be at the head of affairs, many abuses would be the consequence. Among other employés, His Majesty the King supports a Recollet Father at this establishment, with the title of Aumonier. This iron is preferred to the Spanish iron, and is sold off at the King's stores in Quebec at the rate of from 25 to 30 castors (beaver skins) per hundred weight. In order to obtain a better knowledge of the position of these works, I would refer to the notes sent to the Court of France on this subject, wherein will be found all details of their management. I may say, however, in conclusion, that they are unprofitable to the King, and I am assured that if they were offered on lease at public sale, one hundred pistoles per annum might be procured for them. After a splendid dinner at M. de Rouville's mansion, we returned to Three Rivers highly pleased with our visit, and took supper at M. de Tonnancour's. The distance from the town to the forges is nine miles."*

It would appear as if the forges produced more iron than the colony could consume, and that, although some was exported to France, the authorities there would not be convinced that it was fit

* Taken from the *British and Canadian Review*, Vol. i., No. 2, January, 1863, by M. Macaulay.

for firearms; so it was proposed to form a naval establishment in Canada and make use of this Canadian iron in shipbuilding. Orders were accordingly given for erecting docks at Quebec for building men-of-war, but nothing was in effect accomplished.*

We next hear of these forges in the articles of capitulation between their Excellencies Major-General Amherst, Commander-in-chief of His Britannic Majesty's troops and forces in North America, on the one part, and the Marquis de Vaudreuil, etc., Governor and Lieutenant-Governor for the King in Canada, on the other, on the 8th of September 1760.

Article XLIV says: "The papers of the Intendancy, of the officers of Comptroller of the Marine, of the ancient and new treasurers of the King's magazines, of the officers of the revenue, and *forges of St. Maurice*, shall remain in the power of M. Bigot, the Intendant, and shall be embarked for France in the same vessel with him; these papers shall not be examined."

The Intendant arrived safely in France, but was at once seized and imprisoned, and made to disgorge most of his ill-gotten gains.† The forges and all pertaining to them now passed into the hands of the British Crown, and, although for some years there are no records, there is no doubt that they were worked.

In 1767 the Crown, which was represented at that time by Governor Murray, leased the tract of land and works for sixteen years from the 19th of June, to Christophe Pellisier, Alexandre Dumas, Thomas Dunn, Benjamin Price, Colin Drummond, Dumas St. Martin, George Alsopp, James Johnson, and Brook Watson, at a rental of £25 currency per annum. In 1775 the American invasion occurred, when it appears that Pellisier helped the invaders with both goods and money, and went to see them at Holland House, near Quebec; he also cast shot and shell for them to be used in the siege of Quebec, and finally, the night before the battle of Point du Lac, where the invaders were beaten by the English under General Carlton, he ran off to Sorel and the United States, taking with him all the funds, as also the vouchers for the money advanced to the Americans, about £2000, got them cashed, and sailed for France. This crippled the company, but, by dint of hard work, they managed to recover and continued operations till the expiration of their lease.‡

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* *History of America* by William Russell, of Gray's Inn., London, 1778, Book iv., p. 372.

† Parkman's *Montcalm and Wolfe.*

‡ F. C. Wurtele.

On the 10th June, 1783, Conrad Gugy was the new lessee, and his term was for sixteen years at £18 15 sterling per year. He sold the balance of his lease on the 10th of March, 1787, to Alexander Davidson and John Lees for the sum of £2300 currency. This partnership was subsequently dissolved, as on the 6th of June, 1793, Alexander Davidson sold the balance of his lease to George Davidson, David Munro, and Matthew Bell for £1500 currency. Their term expired in 1799, but, on the 30th of May in that year, they were granted an extension to the 1st April, 1801, at the same rental.

A new arrangement was now made, Munro & Bell entering into a five years lease and paying an annual rental of £850 sterling. This lapsed in 1806, but they continued to hold it on sufferance till the 1st of January, 1810, when they secured a lease for twenty-one years, at £500 per annum.

At this time the manufacture of iron was the most important industry in Canada,* there existing then a considerable export of cast-iron articles, particularly of stoves.

From year to year the place had grown. The following account gives an idea of what it was: "The establishment is furnished with every convenience necessary to an extensive concern, the furnaces, the forges, the founderies, workshops, etc., with houses and other buildings, present the appearance of a tolerably sized village. The principal articles manufactured are stoves of all kinds used in the Province, large potash kettles, machines for mills, and various kinds of cast and wrought iron, also a great quantity of pig and bar iron for exportation. The number of men employed is from 250 to 300. The overseers and persons employed in the construction of models are English and Scotch, the workmen are generally Canadians."†

The inhabitants in the District now began to complain that so much land was leased to the forges that "the town of Three Rivers was hemmed in at the back," and that people who desired to settle in that neighborhood could not obtain any land; this irritation was further increased, "by a proclamation the lessees induced Lord Dalhousie (Governor from 1820 to 1828) to issue, prohibiting even the making of maple-sugar on the land in question. This had been an immemorial source of advantage to the inhabitants around; in the season from 300,000 to 500,000 pounds were made each year. Even the pretence of destruction to the fuel could not be made for this, as tapping the trees did not destroy them for wood."

* *Letters from Canada*, Hugh Gray, London, 1809, p. 22.

† Bouchette's *Lower Canada*, 1832. St. Maurice.

The Honorable Matthew Bell, Seigneur of St. Maurice, was a man of great importance; he lived in princely style in his chateau at the forges, where he kept a stud of horses and a pack of fox-hounds, and when his lease expired on the 31st of March, 1831, he was able to get it renewed by orders-in-council from year to year till 1846. He died shortly afterwards, and at the time of his death was in very reduced circumstances, being insolvent before he gave up the forges.

The Crown now resolved to sell the property, and it was bought at auction by Henry Stuart, Advocate of Montreal, on August 4th, 1846, and was leased by him to James Ferrier, of Montreal, who worked it for some years.* Henry Stuart finally sold his interest to Andrew Stuart and John Porter, of Quebec, who abandoned it in 1859, as it did not pay.

It appears that when Henry Stuart purchased the property he paid very little, if anything, on it, and the balance of the purchase-money not being paid when due, the Crown obtained a judgment against him and seized the property, which was sold by the sheriff on the 22d October, 1861. "The forges not bringing the value set upon them by the Crown were acquired by them for $7200,"† and sold (together with a farm attached, but without any more land) the following year to Monsieur Heroux, of St. Barnabé, for $7000, who in his turn sold the forges, retaining the farm, to John McDougall, for £1700 currency. This price included the furnaces, works, house, cottages, water-privileges, etc. All the land formerly pertaining to the forges was sold to the squatters and settlers who supplied ore and wood to the works, which were now once more resumed. Their product, however, was chiefly used in the manufacture of car-wheels, and so the trade in stoves and hollow-ware gradually fell off.

The property is now owned by George McDougall, of Three Rivers, the furnace having been in blast till the summer of 1883, when, owing to the ore and fuel becoming exhausted, it was finally closed. When working, it was *the oldest active blast-furnace on the American continent.*

This statement is made upon the authority of Mr. James M. Swank, late Secretary and now Vice-President and General Manager

* The Hon. James Ferrier informs me that he occupied and worked the forges for four years, from 1847 to 1851.

† Extract from report of Commissioner of Crown Lands, 1861. I am indebted for this information to Mr. J. T. Judah, of Montreal, late Superintendent of Crown Domain and Jesuits' estate, Department of Crown Lands.

of the American Iron and Steel Association; a short account is given of the works in his "Statistics of the Iron and Steel Production of the United States," which he, as special agent, compiled in 1880, for the tenth census of the United States, and more recently in his *History of the Manufacture of Iron in all Ages*, published last year, wherein Mr. A. T. Freed, of Hamilton, Ont., and Dr. T. Sterry Hunt, of Montreal, are acknowledged as having contributed most of the information as respects these forges.

Through the kindness of Mr. F. C. Wurtele, Librarian of the Quebec Literary and Historical Society, and also of Mr. H. M. Price, of Quebec, I have been enabled to give fuller particulars than are furnished by Mr. Swank. In addition to those thus named, other authors and authorities have been carefully consulted in my endeavor to give a complete account of the Saint Maurice forges, from their rise to their close; for they are unique in the history of this country.

Iron Works at Batiscan.—About the year 1798, a blast-furnace and casting-house, two forges, a saw- and grist-mill, besides other workshops and dwelling-houses, were built on the east side of the Batiscan River, about six miles from its mouth. The works were situated in the seigneurie of Batiscan, County of Champlain, were in operation some little time, and were similar to those at St. Maurice; but the proprietor died, and the place was shut up. Both ore and wood are reported to have been more plentiful here than at St. Maurice.*

An interval of sixty years now occurs before we again hear of a new enterprise.

The Radnor Forges.—The Radnor forges at Fermont, in the seigneurie of Cap de la Madeleine, County of Champlain, are situated about ten miles from Three Rivers, on the Piles branch of the North Shore Railway, and were erected about 1860, by Messrs. Larue & Co.,† the firm consisting of Larue, Turcotte, and G. B. Hall & Co. The establishment was extensive, consisting a blast furnace, forge, and large rolling-mill; a car-wheel foundry in Three Rivers, 40,000 acres of freehold land (timber and ore lands) also forming a part of the property. Sir William Logan, in his Geology of Canada, 1863, says: "The crude ore is brought to the furnace partly by the workmen of the company and partly by the farmers on whose land it is found. It is washed to free it from adhering earth, and then yields from forty to fifty per cent. of metal; about 2000 tons of cast-iron

* Bouchette's *Lower Canada*, 1832.

† *Can. Geol. Survey*, 1863.

being now produced annually from between 4000 and 5000 tons of ore. The number of men employed at the Radnor forges varies from 200 to 400, a great many hands being required at certain seasons to dig up and bring in the ore, and to prepare and transport the charcoal.

"The chief manufacture of the company has, of late, been cast-iron wheels for railway-cars, for which the metal appears well adapted. A pair of car-wheels, which were said to have run 150,000 miles with an axle of this manufacture, were sent by Messrs. Larue & Co., the proprietors of the forges, to the International Exhibition of 1862. Wrought-iron is also made at this establishment, and a rolling-mill has recently been erected here, which furnishes iron for the manufacture of scythes and nail-rod iron."

The rolling-mill and forges, etc., have since been destroyed by fire, and at present the blast-furnace is in operation, turning out about four tons of iron per day. The ore is dredged up from the bottom of Lake Tortue, delivered on railway-cars, and carried direct to the furnace, whilst the iron is still used for car-wheels in the wheel-foundry at Three Rivers, now leased to Mr. George McDougall. Over a million dollars have been sunk in these works since their commencement, through bad management and disastrous fire.

L'Islet Blast-Furnace.—This furnace was built by the Messrs. McDougall, the proprietors of the St. Maurice forges, about four mile from those works,* but it has not been in operation for some years.

Iron Works at Hull.—In 1857 the Canada Iron Mining and Manufacturing Company of Montreal built a blast-furnace at Hull, near Ottawa, and, for a time, in that and the following year, produced a superior quality of pig-iron, but "the economic results not being satisfactory," the working was stopped, and the furnace, being much injured by a forest fire a few years afterwards, was abandoned.†

Smelting in Yamaska.—The St. Francis River Mining Company, in 1869 erected a blast-furnace in the county of Yamaska, near the Rivière aux Vaches, and kept it working until 1873, producing in that time 5520 tons of charcoal pig-iron. The property was purchased in that year by Messrs. John McDougall & Co., of Montreal,‡ and operated by them till 1880, when the bog-ores hav-

* *Geol. Survey*, 1873–74.

† *Geol. Survey*, 1866–9, 1873–4

‡ *Geol. Survey*, 1873–4

ing been exhausted within a paying distance from the furnace, it was dismantled.

Baie St. Paul Iron-Works.—Two blast-furnaces, extensive buildings, and a railway from the works to the river, were completed in 1873 by the Canadian Titanic Iron Company, near Baie St. Paul, on the north shore of the St. Lawrence, about sixty miles below Quebec, for the purpose of smelting the titaniferous iron-ore of that region.* The furnaces were only in operation a short time, the cost of production being too great. The place was never worked again, and was dismantled in 1880.

Grantham Iron-Works.—Messrs. John McDougall & Co., of Montreal, in 1880 and 1881, built two blast-furnaces at Drummondville, on the River St. Francis, in the Township of Grantham, County of Drummond. They are still in active operation, and are known as the Grantham iron-works. The resident manager, Mr. Robert McDougall, has kindly furnished the following particulars: "The blast-furnaces are each thirty-four feet high, with boshes of eight and ten feet respectively. They are worked with hot and cold blast, and the air-pumps are driven by water-power from the River St. Francis. The fuel used is charcoal, and the bog-ore, which contains about 40 to 45 per cent. of iron, is obtained about three miles from the works. The annual capacity is 4000 tons, and the product charcoal pig-iron for car-wheel purposes."

A siding from the Southeastern Railway runs directly into the works, and the iron is made into car-wheels at the foundry in Montreal.

Moisic Iron-Works.—The Moisic Iron Company was originated in 1867 to work the iron-sands on the north shore of the Gulf of St. Lawrence.

Dr. Sterry Hunt, in his "Notes on Iron and Iron Ores," in the Geological Survey Report of 1866–69, says:

"The great deposits of black iron-sand on the beach near the mouth of the Moisic river having attracted attention, various attempts to reduce it were made. In January, 1867, Mr. W. M. Molson of Montreal, had the ore successfully treated by the bloomary process, in northern New York, and the result proving satisfactory, several bloomary furnaces were, in 1867, erected by him at Moisic, and have since been in successful operation."

A forge and rolling-mill were subsequently erected in Montreal

* *Can. Geol. Survey*, 1873–4

to work up the loops or blooms, which were made into forgings, etc., and also exported to the United States.

The proprietor having lost a large amount of money was obliged to close both the works at Moisic and those in Montreal, and they were dismantled and sold in 1876 or the following year. The action of Congress, no doubt, which prevented the export of the blooms to the United States by refusing to allow them to be classed as pig-iron deprived him of the only market there was, for that class of iron, and was the cause of the mercantile failure of the enterprise.

Quebec Steel-Works.—An attempt was made in Quebec to work these sands. Mr. B. J. Harrington, B.A., Ph. D., in his "Notes on the Iron Ores of Canada and their Development," in the Geological Survey Report of progress for the year 1873–4, thus describes it:

"In the month of June last, I had an opportunity of visiting the steel-works erected at Quebec for the purpose of manufacturing steel directly from the purified sands of the Gulf. Since the death of Mr. Labreche Viger, the works have passed into the hands of a new company, the president of which is Mr. Chinic, hardware merchant of Quebec. The enterprise, so far as I could learn, has not been successful, and at the time of my visit, nothing whatever was being done. The furnace is a well constructed Siemens regenerative furnace, with five gas-producers, and, except in the construction of the hearth, which is perfectly flat, and in one or two other minor details, resembles the one employed by Messrs. Cooper and Hewitt at Trenton, N. J., in the manufacture of steel according to the Siemens-Martin process.

"In making steel, the sand, which had been purified by Dr. LaRue's magnetic machine, was mixed with tar and charcoal-powder in a box containing revolving knives or beaters, and the mixture was then pressed into square blocks by means of a hydraulic press. The blocks were then piled upon the furnace-hearth and melted down to steel, which was finally tapped off into ingots containing about 200 pounds.

"The cause of failure I was not told, but difficulty was probably experienced in obtaining a regular and homogeneous product."

Mr. Chinic subsequently stated "That further and rather more successful experiments have lately been made with the furnace, and ten or twelve tons of steel produced. A good deal of difficulty was experienced in pouring, and the ingots were frequently *honey-combed*, and after forging were liable to contain flaws. Not

more than 500 pounds of steel were produced at a melting, which required six hours." Nothing more was done, and the works were abandoned.

Haycock Iron-Works.—In the winter of 1872–73, still quoting from Mr. Harrington, "The Haycock Iron Mine was opened, and about 5,000 tons of ore raised." The mines are situated about eight miles northeast of the City of Ottawa, in the Province of Quebec, and the works consisted of a "steam saw-mill, bloomary forge, engines, pumps, steam-hammer, workmen's cottages, stables, etc. Some blooms were made and exported to England; the iron was of very fine quality, but the enterprise was not commercially successful and the place was closed, and has not for some years been used. The Ottawa Iron and Steel Manufacturing Company recently acquired the property.

Experimental Works in Montreal.—The Canadian Iron and Steel Company, of Montreal, were incorporated in 1881 to test an invention of Dr. George Duryee, of New York, for making wrought-iron direct from the ore. The process was patented, and was called the "blow-pipe process." Crude petroleum was the fuel used, it being dripped into a strong blast and vaporized. An experimental furnace had been built in Toledo, Ohio, and some iron is claimed to have been made there with, however, very doubtful results; but the inventor, sanguine, after his kind, urged that by certain improvements in the furnace, eventual success could not be a matter of doubt.

A site was chosen in Hochelaga, a suburb of Montreal, and about a twelve-month was occupied in perfecting the machinery and getting everything ready. The furnace consisted of an iron cylinder lined with firebrick; the cylinder was inclined and made to revolve; it was 120 feet long and 5 feet in diameter for 100 feet, the remaining 20 feet being 10 feet in diameter. The iron-ore was ground fine and mixed with flux, and introduced into the elevated end of the cylinder and gradually worked down as the cylinder revolved. The heat from the combustion of the vaporized oil was intense; and when under its influence the particles of ore began to melt, they stuck together, and by the time they reached the "puddling chamber" at the enlarged end, should have gathered into balls, which, when ready, were to be taken out and hammered into blooms.

The experiments were continued about twelve months, and iron-ore from Hull, Baie St. Paul, Moisic sand and bog-ores were tried with

limestone, clay and quartz as flux, but although a small quantity of iron was produced, the experiments could not be called successful; and so after spending some $70,000 or $80,000 they were stopped.

Montreal Iron-Works.—In Montreal there are, at present, four rolling-mills which manufacture iron for their own use from wrought iron scrap and imported puddled bars. For tack-making the best quality of English sheet-iron is imported and Swedes charcoal tack-strips, the product being spikes, nails, horse-shoes, tack-brads, springs, bolts and nuts in the one case, and butt-welded iron pipe in the other. They may be enumerated as follows:

1. The Montreal Rolling Mills Company, which manufacture cut nails, pressed nails, horse-nails, tacks, brads, etc., and iron pipe butt welded. Both mills are worked by steam-power.

2. Pillow, Hersey & Co.'s works, which produce cut nails, railway and pressed spikes, horse-shoes, cut tacks, brad and shoe-nails, also carriage, tire and other bolts, coach-screws, hot-pressed and forged nuts, etc. The rolling-mill is run by steam and the bolt-factory, etc., by water-power.

3. The works of Peck, Benny & Co., which produce nail-plate, cut nails, clinch and pressed nails, horse-shoes and horse-shoe nails, ship- and railway-spikes, and tacks of all sorts. These works are operated by water-power.*

4. The Metropolitan Rolling Mills, Abbott & Hodgson, proprietors, manufacture railway and ship-spikes, horse-shoes, clinch, pressed, cut, barrel, box and other nails. This mill is run by steam-power.

II.

Early Enterprises in Ontario.

The first attempt to manufacture iron in Ontario was made at Lyndhurst, then called Furnace Falls, on the Gananoque River, in the County of Leeds. This county was first settled in 1785, and its boundaries established by proclamation of the 16th July, 1792.

About the year 1800, a company composed of Ephraim Jones, Daniel Sherwood, Samuel Barlow and Wallace Sutherland erected a blast-furnace at the Falls, the water-power being no doubt utilized to drive the machinery and work the blast.

"The ore was of inferior quality and had to be drawn a considerable distance; consequently the enterprise was not a financial success,

* Taken from Mr. W. J. Patterson's Board of Trade Report, 27th August, 1883.

being abandoned after two years' trial. At one time, an attempt was made to cast hollow-ware for the use of settlers, including pots and kettles, but proved a complete failure." Such is the account given by Thad. W. H. Leavitt, in his history of the united counties of Leeds and Grenville.*

A forge for the manufacture of bar-iron was built about the same time for the same company, and was in operation until 1812, when, from want of capital, and on account of the derangement to business consequent upon the war of that year, the place was shut up and never opened again. The ruins are still visible.†

Normandale Furnace.—The next attempt made was in Western Ontario, at Normandale, then known as Potter's Creek, in the township of Charlotteville, in the County of Norfolk, in the then London district. The boundaries of the county were established by proclamation the 16th July, 1792, and the township contained 900 people and 132 inhabited houses in 1817.

In the year 1815, Mr. John Mason, an Englishman, undertook to manufacture iron, and in two years' time he had a blast-furnace in operation, which was "of a rude and primitive description, entirely the labor of his own hands, with the exception of the machinery for the blast. The bellows were formed out of two hollow whitewood trees. It is thus that the spirit of enterprise and necessity, which has so truly been called the mother of invention, enables an individual in this young country to overcome difficulties which in other situations would be considered insurmountable."‡

Mr. J. Harris, R. N., who furnishes the information, goes on to say in regard to the situation chosen for the furnace: "With respect to water they have a great advantage. Potter's Creek, though not large, is a never failing stream. The works are situated at its entrance, immediately on the shores of Lake Erie, hence the great convenience of sending off their weighty manufactured articles, or of receiving any supplies which they may require, without the expense of land-carriage. Moulding-sand is abundant on the site of the furnace, and timber for charcoal is easily obtained and in great variety; the hard maple is preferred."

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* Brockville, 1879, p. 62.

† I am indebted to Mr. S. McCameron, of Gananoque, and Mr. E. C. Slater, of Sweets Corners, Ont., for these particulars.

‡ Lieut. Baddely's paper in Lit. and Hist. Soc., Quebec, 1830. Vol ii., p. 420.

In Robert Gourlay's *Statistical Account of Upper Canada*,* the following letter from Mr. Mason is to be found:

POTTER'S CREEK, Dec. 4th, 1817.

"SIR,

"You desired me to give you every information in my power of the probability or certainty of making iron in this part of the province, so as to be beneficial to the manufacturer and the public. I will state to you what is for and what against. In favor of iron-works is the high price of iron and plenty of timber for coal; everything but these is against the first beginner. The bog-ore is scattered over the whole country, but I do not know of any one bed of ore that will exceed 120 tons. I spent three months in examining the country for ore, and I calculate that it will take all the ore I found within twenty miles of this place to supply a small furnace for seven years; but I believe considerable quantities within that space are not yet found. No rock ore has as yet been found in this part of the province, and if there is any, it must be at considerable depth from the surface of the ground and will be difficult to find, as the strata lie horizontal. Another thing against iron-works is that it will require many experiments before we can know the best method of working the ore, and there is not any stone in this part of the province that will stand the fire, and I believe it will be best if it comes from three different places in the United States. I want five or six pieces of iron, each 30 cwt., these will come to an enormous expense. I intended to ask the Government to give or lend me five or six disabled cannon for this. I asked the Government to pay the passage of five or six families from England to work in the furnace. This could not be granted, and therefore I would not ask for the cannon. Another thing against me is that there is not a man in the country that I know capable of working in the furnace. But the greatest difficulty I have to overcome is iron-men, as we call them, who are the very worst sort of men to manage, colliers not excepted. Not one of a hundred of them but will take every advantage of his master in his power. If I have just the number of hands for the work, every one of them will know that I cannot do without everyone of them, therefore everyone of them will be my master. Anxiety and trouble will be the consequence; and if I keep more hands than are necessary, so as to have it in my power to turn those away who will not do right, this will be expensive. But, after all, if the ore is as good as I expect, I hope to reduce the price of iron very considerably. The place where I am is a reserve lot. Governor Gore has promised encouragement to the works, when the Government is satisfied they will answer a good purpose. If Governor Gore does not return to this country, and what he promises should be refused me, iron-works will be at an end with me and at this place; but I shall not ask for the promise until the inhabitants of the country will be my bondsmen for the benefits arising from the iron-works. When I saw you I offered a considerable sum of money to take them off my hands; this I repeat, not but what I believe they will answer, but the trouble will be more than equal to any profit from them. Those who begin iron-works in this country after me will start many thousand dollars ahead of me, everything they want except stone, will be had here, the best method of working the ore will be known, and men will be learned to work it.

"I am, sir,
"Your obedient servant,
"JOHN MASON."

* London, 1822.

Poor John Mason never reaped any benefit from his enterprise and perseverance. He had only made a few tons of iron when the inner wall of his furnace gave way and it became "bunged up," so that it was of no use. This discouraging event seemed to prey on his mind, and he sickened and died, leaving the property to his widow and son.

In 1820 the property was purchased by Mr. Joseph Van Norman, who is now in the 89th year of his age, and is living at Tilsonburg. The following particulars were obtained from him and kindly furnished by his son, Mr. G. R. Van Norman, Q. C., of Brantford.

In 1821 Mr. Van Norman formed a partnership with Mr. Hiram Capron, late of Paris, and Mr. George Tilson, late of Tilsonburg, and commenced building a blast-furnace, which was completed and put in blast in 1822, after an expenditure of $8000. The iron turned out was of excellent quality, and the ore fairly rich. It was bog-ore and was found in the swamps and marshes in the vicinity, being hauled in by wagon-teams, a distance varying from six to twelve miles. The average consumption per day was nine tons, producing about three tons of pig iron. The furnace would be in blast about eight or nine months out of the year, running night and day, and producing 700 to 800 tons of iron, with an annual consumption of fuel equal to 4000 cords of hard wood, made into charcoal in the usual way.

In 1830 the works were burnt down, but were immediately rebuilt on an extended scale.

In the early stage of the enterprise all the iron made was converted into various kinds of castings, there being no market for pig-iron; and as a consequence, the wants of the country at that time becoming overstocked, some was exported to Buffalo, and a vessel-load of stoves and castings sent to Chicago. The wares produced were disposed of along the shores of Lake Erie, from Fort Erie to Amherst Bay, and taken into the interior of the country by teams. Before the opening of the Welland Canal, stoves, kettles, and other iron-ware were sent very long distances by teams, particularly in winter, going as far as Chatham, Waterloo, and beyond St. Catherine's. After the opening of the Welland Canal (the first vessels passed through in the year 1829), places on the canal and Lake Ontario were accessible by water, and accordingly two vessels were employed by Mr. Van Norman, and kept busy during the summer. Hamilton, Toronto, Port Hope, Kingston, etc., were thus supplied, and from these centers the wares were distributed into the

back country. Some of the goods were sent as far as Montreal. The business seemed to be the right thing for the country, and started at the right time to be of use to the new settler, to furnish him his sugar-kettles and his kettles for boiling the ashes gathered from the burning of his log heaps. At that time the potash made from these ashes was the only exportable article which could be shipped to foreign countries and for which money could be obtained.

There was in those days no money in the country, and business was carried on by barter or exchange of commodities. Anything the people had to sell was brought to the furnace and exchanged for the wares in payment, or due-bills were taken, payable in iron-ware. Due-bills were in this way used as a kind of circulating medium over a large section of what is now the Province of Ontario. At one time the books of the establishment showed outstanding over $30,000 of these demand due-bills for iron, and then for a time the practice was discontinued.

At the expiration of five or six years, Mr. Joseph Van Norman, who was the managing partner, and gave the name of Normandale to the locality, bought out his partners and took his brother Benjamin into the business; but he retired after a few years, and the concern was carried on in the name of J. Van Norman & Son till 1847. By this time both fuel and ore were well-nigh used up in the neighborhood of the furnace, and it was abandoned. The firm had also a forge in the vicinity of Port Dover, where for some years they carried on the manufacture of bar-iron for horse- and sleigh-shoes.

After the closing of the Normandale furnace, its owner paid a visit to the Marmora Iron-Works, which will now be described.

Marmora Iron-Works.—The Township of Marmora, in the County of Hastings has long been noted for its iron-ores. "In 1821 the township was first advertised for sale, but from the rocky and swampy character of a large portion of the land it did not make much progress towards settlement, and, in 1850, only contained 593 inhabitants."*

The village of Marmora is situated on the Crow river, 41 miles from Peterboro, 32 miles N.N.W. of Belleville.

Iron-works were first commenced at Marmora about the year 1830 by a Mr. Hayes, who, after spending a large fortune and the fortune of his wife, had to give up the property to his creditors; the late Hon. Peter McGill, of Montreal, to whom over £40,000 was owing,

* Smith's *Canada*, 1851, p. 246.

in this way came into possession of the place, and the works were for a time carried on in his interest, under the management of a Mr. Manchan, who represented Kingston in the Upper Canada Parliament; but they resulted in a heavy financial loss.

In 1847 Mr. Van Norman visited the works and was tempted by the appearance of the great ore-beds in the immediate vicinity (the Blairton Big Bed) and the general appearance of the place, to continue to Montreal and see Mr. McGill; he did so, and bought the property for $21,000.

In the fall of the same year he moved to Marmora, and after expending a large sum in fitting up the furnace, putting in machinery, ovens, blowing-apparatus, erecting and repairing buildings, cutting cord-wood and making it into charcoal for fuel, everything was finally ready and the furnace was started the following summer. The result was a bitter disappointment, for after being used to an easily reducible bog-ore, Mr. Van Norman now had to treat a rock-ore, very rich in metallic iron. The amount of charcoal used per ton of iron was consequently very large, and nothing but loss attended every effort he made. After the iron was made it had to be carted thirty-two miles to Belleville, over rocks and "corduroy" roads so rugged that the wagons were constantly breaking down, and even the shoes of the horses were pulled off, roads existing merely in name. It was found absolutely necessary to get some new route, so a road was opened from the works to Healey's Falls, on the river Trent, a distance of nine miles, and the iron taken from there by steamboat to Rice Lake, and carted thence twelve miles to the dock at Cobourg.

Up to this time iron ranged in price from $30.00 to $35.00 per ton, and found a ready sale at these prices. In 1848, however, the St. Lawrence canals were completed, and England had adopted the principles of free trade, the consequence being that pig-iron was brought up and sold in Belleville and Cobourg at $16.00 per ton. This settled the question of making charcoal pig-iron for Mr. Van Norman, who quotes these prices. He had to stop the works and lose everything, not having even money enough left to get away from the place. Relief came, however, unexpectedly in the shape of a letter from Mr. McGill, expressing regret at his failure and inclosing a cheque for £100.

We shall again hear of Mr. Van Norman in iron-manufacturing enterprise, but must first complete the story of Marmora.

The next proprietor was a local concern from Belleville, called the

Marmora Foundry Company. A gentleman connected with the company furnished the following.*

"A company was formed in Belleville for the purpose of purchasing the property and making another attempt to work the mines. The Marmora Iron-Works, the property of the Marmora Foundry Company, are situated on lots Nos. 9 and 10, in the fourth concession of that township. The works, which are erected on the bank of the Crow River, a short distance from the foot of Crow Lake, are very extensive, and consist of two blast-furnaces of good size, one of which has been within a few months almost newly built and lined with Stourbridge brick, and is ready for use at any time when the operations of the company may be resumed. The blast (which is called the "hot-blast") is furnished by a new and improved cylinder apparatus with air-heating ovens on the most approved principle, and is driven by a powerful and never failing stream of water. This furnace has been in blast but for a short period, and that only for the purpose of testing the practicability of working the ore, so as to produce such a quantity of iron per diem, as would leave reasonable expectations of the manufacture proving profitable. The company therefore spared no expense in fitting up the furnace, which was done under the superintendence of an eminent iron-founder and practical assistants. The quantity of iron (pig) produced from this furnace was five tons per day of very superior quality, and it was found that the probable cost of manufacture, in a blast of longer duration would not exceed three pounds, or three pounds five shillings per ton.

"Owing to some difficulty between the directors and a portion of the stockholders, who had refused payment of their stock, the works were stopped after this experiment, and will not probably be resumed for a year or two unless the company succeed in leasing the premises to some practical person, a course which they would prefer rather than carry them on in future on their own account.

"The premises of the company are very extensive, and comprise (in addition to the blast-furnaces and several large houses for storing charcoal) a large stone building with trip-ham.. r, for the manufacture of bar-iron, several stone buildings and houses, used for shops, boarding-houses, etc., and about twelve frame dwelling-houses occupied formerly by the work-people of the establishment, which are now rented out to various parties. There are also a flouring-

* Smith's *Canada*, 1851, p. 247.

mill, a saw-mill, and a building formerly a tannery, but now about to be converted into a clothing- and fulling-factory, all driven by the same stream (which is capable of propelling three or four times as much machinery from the same head) over which a very handsome and suitable bridge was built last year. A church (Roman Catholic) built of stone and of very neat construction, is situated nearly opposite the bridge, on the western bank of the stream. All of these buildings are on the property of the company and form together a compact and flourishing village, in which is a post-office. On the north side of the village, and also on the property of the company, a town-plot has been laid out, and a few lots sold, on which buildings are now being erected by the purchasers; but the whole of the grounds on which the buildings above described stand is intended by the company to be reserved for the purpose of leasing to tenants. On the south side of the village is a well cultivated farm, with handsome dwelling-houses and suitable out-houses, gardens, etc., also the property of the company.

"The ore-bed (or rather the main ore-bed from which the furnace was supplied, for there are many valuable beds of magnetic iron-ore in the neighborhood and some of bog-ore) is situated on a high bank on the shore of Crow Lake; it is mined easily and loaded on board scows for transport to the works, from which the ore-bed is distant about three miles and a half. The ore is a magnetic oxide, very rich, three tons yielding two tons of iron. Excellent as is the cast-iron made from this ore, it is still more suituble for bar-iron, the toughness and ductility of that which has been made there giving it a preference to the best Swedish iron. Marble and lithographic stone are also on the property of the company; samples of the latter were sent to the great exhibition at London and received (as did also the iron and specimens of ore sent) favorable notices from the English press." From authentic accounts, this company sunk about £20,000 in their venture.

In 1856 an English company came to the fore. Mr. Wm. Hainsworth, now Superintendent of the Pittsburgh Steel Casting Company of Pittsburgh, Pa., one of the largest and most successful works of this sort in the United States, was sent out from England to Marmora, and Mr. Vernon Smith, who had just left the Weybridge Iron-Works of New Brunswick, took charge. He rebuilt the old furnace and afterwards built a new one cased with iron. The place seems to have been dismantled before he took charge; it was, however, again put into working order, but did not run long. Mr.

Smith says "the iron was too rich for economical working in a blast-furnace, if flux was not very largely used; the iron being converted into wrought-iron and *burning*, not melting." By the time they stopped, Mr. Van Norman estimates they had lost not less than £70,000.

In 1866, one of the furnaces was put in blast by a Mr. Bentley, of Marmora, and remained working for forty days,* and in 1867 the property passed into the hands of an American company, which mined the ore and shipped it to Pittsburgh. In 1869, they amalgamated with the Cobourg and Peterboro' Railway Company, and have since been known as the Cobourg, Peterborough and Marmora Railway and Mining Company. They for some years shipped annually a large quantity of ore, a railway having been built on the same route Mr. Van Norman had opened to Cobourg.

In 1875 an attempt was made by Mr. W. H. Fraser, now of Ottawa, to smelt iron-ore with crude petroleum in one of the Marmora furnaces. In the proceedings of the Iron and Steel Institute of England, for that year, a short notice is given of it, but they "fear not much good will result." The experiments were not commercially successful.

Madoc Blast-Furnace.—In the year 1835, Mr. Uriah Seymour, of Wolcott, Wayne County, New York, took some iron-ore from Madoc, in the Township of Madoc, County of Hastings (not very far from Marmora), and tried it in his furnace at Wolcott, and two years afterwards built a blast-furnace at Madoc. He was never able to produce much iron, but succeded in losing all his means, and his partner having been killed in the mine, Mr. Seymour closed up, and the place has never since revived.†

Houghton Iron-Works.—We now hear again of Mr. Van Norman, and with him of the last smelting-enterprise in Province. After his failure at Marmora, he returned to his old home at Normandale. About this time the Great Western Railway (now G. W. Div. G. T. R'y.) was under construction. Messrs. Fisher and McQueston, of Hamilton, Ont., were furnishing car-wheels to the Company and had a great deal of trouble to get charcoal iron suitable for making car-wheels. The iron formerly made at Normandale was just the kind which was wanted, and an offer was made by them to Mr. Van Norman, to take all the iron he could make, at a price which promised to pay well, viz., $45.00 per ton. A contract

* *Can. Geol. Survey*, 1863, p. 676, and 1866, p. 108.

† *Can. Geol. Survey*, 1863, p. 675, and 1866, p. 109.

was entered into, a clause being therein inserted, providing that the iron should be suitable for the manufacture of car wheels. A person was at once sent into the Township of Houghton, in the County of Norfolk, to prospect for bog iron ore, and on his having reported that it could be found in sufficient quantities, a blast-furnace was at once built and placed in operation in the fall of 1854. In the following spring, 400 tons of iron were shipped, but upon being tested this iron was rejected, as it would not chill. It had to be sold and only brought $22.00, which was below the cost of production; so the works, which had cost about $30,000, were abandoned, and Mr. Van Norman's career of over thirty-four years in the blast-furnace business ended, he having unfortunately lost at Marmora and Houghton all that had been made at Normandale.

Furnace Falls Iron Company.—After an interval of eighteen years, during which time a number of projects had been talked of, a blast furnace was commenced in 1882 by Messrs. Parry and Mills, of Chicago, at a place they named Furnace Falls, on the Burnt River, in the County of Haliburton; but, after an expenditure of about $35,000, the works were stopped for want of capital to complete them, and they still remain in this unfinished condition.

Apart from blast-furnaces, a number of other iron industries have, at various times been, and some are still, in operation. They may be enumerated as follows:

Toronto Rolling Mills and Iron-Works.—About 1860 Messrs. Gzowski and Macpherson, of Toronto, started a large rolling-mill in that city for the special purpose of re-rolling iron rails; some bar-iron was also made out of scrap. The works were situated in the east end of the city, on the south side of South Front street. About 1873 the place was closed and dismantled, and the land is now owned by the Grand Trunk Railway Company, it being at present the site of their car repair-shops. The cause of the mill being closed was the substitution of steel for iron rails.

In 1866 the Steel, Iron, and Railway Works Company was organized in Toronto and a charter granted by the Ontario Legislature.* The authorised capital stock was $115,000 and the special object of the company was to operate a patent granted to a Mr. Hugh Baines, and dated 27th July, 1865, "for making railroad crossing points, and for putting steel ends or sections on railroad

* Cap. 110, 26–30 Vic.

rails." The works were situated in the west end of Toronto, on the west side of Strachan Avenue, alongside the Great Western (now G. W. Div. G. T.) Railway, and their operations were confined to patching iron rails and making some forgings. The adoption of steel rails closed the works, but they were resuscitated in 1872 by being merged into the Canada Car and Manufacturing Company, a concern chartered by the Provincial legislature,* with an authorised capital of two million dollars, for the manufacture and leasing of railway cars.

"On the 9th of August 1872, a contract was entered into by the Government of Ontario and the Canada Car Company of Toronto, under which the Government leased to the said company for a term of seven years and a half from 1st January, 1874, the labor of all the prisoners sentenced to the Central Prison, except such as was required to carry on the domestic work of the prison.

"This contract provides that prisoners shall not be sentenced to the prison for a shorter period than three months, and that they shall not, through physical or mental defects, be unfit to perform an ordinary day's labor, consisting of ten hours per day, less two hours every week. The Government is to furnish sufficient workshop space (with foundations for machinery and other permanent fixtures) properly heated and lighted, to enable the industry to be carried on, and the boilers, engines and shafting required for motive purposes, not exceeding one hundred horse power,—the engineers and firemen to be provided by the Company as well as the fuel for the furnaces.

"The Company is to employ the prison-labor thus leased, in the manufacture of railway-cars, in all its various branches and requirements, as well as in the maufacture of nails, bolts and spikes of every description, etc.

"For the prison-labor thus leased the Government is to receive from the Company the sum of fifty cents per day for each and every prisoner during the first two and a half years' existence of the contract, for the second two and a half years fifty-five cents, and for the third and last two and half years the sum of sixty cents per day."†

The Company's premises adjoined those of the central prison, which was in course of construction. The prison buildings were

* Cap. 114, 36 Vic.

† Extracts from report of Inspector of Prisons, etc., for 1871–2–3. Sess. Papers, Ont., No. 27, 1874.

not designed for this class of manufacture, but were altered and made to answer, several railway-sidings were laid and the appliances put in were of the latest description. There were also introduced a forge with four large beam-hammers, and the necessary furnaces and plant for the manufacture of locomotive and car-axles, and large forgings out of scrap-iron; several small hammers, a wheel foundry equipped to turn out 120 car wheels per day, a large foundry for soft castings, and shops and machinery for making bolts, nuts, washers, together with a variety of iron- and wood-working tools. Large stocks of wood, iron, coal, etc., were laid in for an extensive business.

From 200 to 350 prisoners were now ready and their wages of fifty cents per day had to be paid. About this time a period of very severe depression set in, and orders for cars were not to be had at any price, and after building about 100 or 200 cars, and altering some trucks for the Intercolonial Railway, the Company collapsed, and the place was subsequently dismantled and sold.

Hamilton Rolling-Mill.—About 1864, the Great Western Railway Company erected a rolling-mill at Hamilton (which cost about $107,000, and had a capacity of about 7000 tons per annum*), to patch and re-roll iron rails; it continued in operation till the 8th March, 1872,† when it was closed. In 1879 it was leased to the Ontario Rolling Mill Company, which is still in operation, and is manufacturing bar-iron, nail-plate, and fish-plates, out of wrought scrap. The mill has now a capacity of about 12,000 tons per annum. A nail-factory is run in connection with it.

Steel Works at Niagara.—A venture in the way of steel-making was tried in 1873, when Date's Patent Steel Company was formed in Toronto, with a capital of $50,000, to manufacture steel under a patent granted the 23d December 1872, to H. H. Date and F. H. Date, for a new process of converting iron into steel, and known as "Dates' steel-converting process." A charter‡ was obtained, and complete works for the manufacture of edge-tools, etc., were erected at Niagara. The product of the factory proved uncertain. Some of the tools, such as axes and hammers, would stand the most severe treatment, whilst others would not, and thus the goods were so unreliable as to be unsalable, and the place had to be closed. Last year some experiments were made there by Mr. A. G. Wright, of Toronto, in the same direction, but with similar result.

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* The Railways of Canada. Trout, 1870–71, p. 93.

† G. W. R. Report.

‡ Chap. 123, 36 Vic.

London Steel-Works.—The London Steel Works Company, of London, Ont., started in 1883, and built works containing one 30-pot Siemens melting-furnace, and a rolling-mill, driven by steam, with a ten-inch train of rolls, the annual capacity being 3,000 tons of cast-steel. The works were put up specially to make steel castings and the Washburn patent car-wheel, which has a cast-iron center, and homogeneous cast-steel tyre. The Company proposed also to make bar-steel flats and rounds, coil-springs and the best qualities of bar-iron. In 1884 a new puddling furnace was built and steam-hammers put in, to make steel and semi-steel by a new process but, these following in the wake of their predecessors, the concern failed and the place was closed.

Forge at Hamilton.—The Hamilton Iron Forging Company, of Hamilton, Ont., make car-axles and forgings out of wrought scrap and have a complete forge. They commenced about 1878 and are still running.

III.

The Manufacture of Iron in New Brunswick.

This Province has not witnessed many attempts to manufacture iron, only one smelting-works having been built. In 1836 iron-ore beds were discovered at Woodstock, in the County of Carleton, by Dr. T. C. Jackson, of Boston, Mass., during a geological survey conducted under his guidance, by the authority of the State of Maine.*

About 1848 The York and Carleton Mining Company obtained a subsidy from the Provincial Government of 10,000 acres of picked land, and expended altogether about $30,000 in erecting a blast-furnace, two blowing-engines, a helve-hammer, operated by a separate small engine, boilers, buildings, etc. Within a year or two, the works and the furnace were injured by a fire. Repairs were made, and the works again put in operation. Another misfortune overtook them. Charcoal was used as fuel, and it one day happened that some small repair necessitated the stoppage of the blowing-engines for a few hours. With the object of saving the charcoal, the furnace was "banked" by piling sods on the top of it; there was a large "receiver" between the two blowing-engines, and by some mistake, the air-valves were left open, gas generated in the furnace, which being "banked" prevented its egress to the outside, and caused it to "back up" through the open valves into the

* *Mines and Minerals of New Brunswick*, by Prof. L. W. Bailey, 1864, p. 55.

air-pipes and receiver. After a stoppage of about four hours, the engines were started again, and on the second revolution an explosion took place, which wrecked the furnace and buildings, and ruined the Company. Mr. Vernon Smith, C. E., who kindly furnished most of the foregoing particulars, came out from England about 1854, as the agent of Mr. Charles Sanderson, of Messrs. Sanderson Bros., of Sheffield, for the purpose of making iron to be used in the manufacture of steel, as, owing to the war with Russia, the supply of iron from that country was stopped.

The works were now rebuilt, and remained in operation for about eighteen months, during which time about 1,000 tons of iron were made. They were then closed and remained idle for some years.

In 1862 the property passed into the hands of Messrs. Morris Best and Ellis Smith, who worked it as "The Woodstock Charcoal Iron Company." White pig-iron was made and exported to England, and was used by Messrs. John Brown and Co., of Sheffield, in the manufacture of armor-plates. Although the iron made is said to have been of superior quality, the cost of the production was too great, and as a consequence the place was closed and has not been operated since. The Woodstock ores are very lean and contain a large proportion of phosphoric acid, besides being very difficult to concentrate The furnace was situated in the village, about three miles from the ore-deposits.

Works for the Manufacture of Wrought-Iron, etc.—The most important of these was incorporated in 1873, as the Coldbrook Rolling-Mill Company,* with a capital stock of $1,000,000, for the manufacture of bolts, screws, axes, rails and railway-iron, boiler-plate, rivets, tools, implements, machinery, etc. A rolling-mill was built at Coldbrook, three miles from St. Johns, N.B., on the Intercolonial Railway, and a nail-factory in connection with the mill was situated a mile or two away on the hill-side, and driven by water-power. Old iron rails and scrap-iron were the raw materials used and were converted into nails, spikes, bar-iron and ship-knees.

The works were in full blast for some years, when the Company failed, and the place lay unused and idle till last year, when the property was purchased by Messrs. I. and E. R. Burpee, of St. John, who are now working it. They advertise that they are now prepared to supply common, refined and horse-shoe bar-iron, nail-plates, mine

* Cap. 121, 36 Vic.

rails weighing eighteen pounds per yard, angle-iron, fish-plates, and ship-knees and straps.

Iron-Works in St. John.—The Portland Rolling-Mill makes nail-plate, forgings, car-axles and ship-knees, etc., out of wrought scrap. The mill is in Portland, a suburb of St. John, and is owned by Messrs. James Harris and Co., the car-builders who manufacture, amongst a variety of other things, the Washburn patent car-wheel, which has a steel tyre, cast homogeneously on a cast-iron centre.

Messrs. J. A. and W. A. Chesley make forgings, ship-knees, etc., at their rolling-mill in Portland, St. John.

IV.

The Manufacture of Iron in Nova Scotia.

A discovery of iron-ore was made in the year 1604, by the Sieur de Monts, who had been appointed the previous year Lieutenant-General of Acadia, by Henry IV of France. He sailed from Havre de Grace the 7th April, and arrived at a harbor on the southeastern side of Acadia. After some explorations around the coast, he doubled Cape Sable, and anchored in St. Mary's Bay. Here they remained several days, and, while surveying the coast, discovered a vein of iron-ore.* At St. Mary's Bay, west of Digby, titaniferous iron-ore is found as sand, forming bands of irregular extent in the beach, the indications being extensive.†

"The first attempt to manufacture iron was made in the first decade of the present century, when a small quantity of bar-iron was made in a Catalan forge from the ores at Nictaux."‡

Moose River Iron-Works.—The next enterprise is thus described, by Haliburton in his History of Nova Scotia:§ "In the year 1825 an association was formed for the manufacture of iron, called the Annapolis Mining Company, with a capital of £10,000, divided into one hundred shares of £100 each. An Act of Incorporation was passed by the Legislature, and the Governor was authorized to grant to the Company a charter under the Great Seal of the Province. It was also protected by a clause of the Act, which provided that no stockholder should be liable for any debts contracted

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* *The Pioneers of France in the New World*, Parkman, p. 220, Also compare *History of Nova Scotia*, Haliburton, 1829, p. 12.

† *Mines of Nova Scotia*, Gilpin, 1880.

‡ Nova Scotia *Mines Report* 1877, p. 43.

§ 1829, p. 162.

by the Company, beyond the amount of his shares. As a further encouragement, two bounties of £600 each were offered for the manufacture of a certain quantity of hollow-ware and bar-iron. The associates immediately purchased an extensive and valuable vein of ore, situated about three and a half miles from the mouth of the Moose River, and another of equal importance at Nictaux, in the upper part of Annapolis Township, with one or two of smaller extent in other places. The local superiority of the former place gave it a decided superiority over any other part of the country, being distant only eight miles from Annapolis, twelve from Digby, and fifty from St. John, N.B., accessible by water, and affording a good anchorage. They therefore selected the eastern bank of the Moose river as the site of their buildings, and erected a large smelting-furnace, coal-houses, stores, etc. (Mr. Cyrus Alger was the superintendent,*) The extensive forest at the head of the river supplied them with an abundance of charcoal.

"They have already (1828) manufactured a quantity of hollow ware, and are now engaged in laying the foundations of forges, for making bar-iron. To carry these objects into effect, they have increased their capital to more than twice its original amount. The quality of the ore has now been ascertained, and the only part of the experiment yet to be decided is, whether they can compete with the English ware, or whether the cost of production will not exceed the value of the article when manufactured, a result which must depend very much upon the economy and skill with which the establishment is managed."

The works were only in operation a short time when "they were suddenly suspended, owing to political causes, but not before excellent iron had been produced, both pig-iron for foundry purposes and refined bar-iron."† For thirty-three years the works were closed, and when operations were resumed, it was for a short time only, to be again neglected for ten years more. In 1872 one hundred and sixty tons of pig iron were made and shipped to Boston, but since that time nothing has been done.

Experiments in Pictou County.—In 1828 an attempt was made by the General Mining Association to smelt some clay-iron-stone and East river ore, in a foundry-cupola, at the Albion Mines, Stellarton, and, as might have been expected, the experiments were not a success.

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* Mines Report, 1877, p. 43.

† Mines Report, 1877, p. 43.

Nictaux Furnaces.—Two blast-furnaces were built at Nictaux (one in 1856), but they did not remain long in blast, and the iron produced is said to have been of poor quality, on account of "the phosphorus in the ores." In 1874 the furnaces were "in ruins, having been partly torn down by the people in the neighborhood to obtain the bricks."*

Bloomfield Furnace.—About 1860 a blast-furnace was put in operation at Bloomfield, to smelt the bog-ores of that district, and it has been in blast several times since then.†

Acadia Iron-Works.—We now come to the most important iron works of the Dominion, viz., those at Londonderry. The great vein of the Acadia mines was discovered by the late Mr. G. Duncan,‡ of Truro. In 1845, Dr. Gesner, and in 1846, Mr., now Sir William Dawson, visited and reported on the iron-deposits in the Cobequid Hills; and again, in 1849, Sir William Dawson, this time in conjunction with Mr. J. L. Hayes, of Portsmouth, N. H., went over the ground; and their report made to Mr. Charles D. Archibald, of London, resulted in the property being developed,§ and a charcoal blast-furnace, with the necessary buildings, being built in 1853 by the Acadia Mining Company. In 1850 a Catalan forge was put up, and a small quantity of bar-iron made, but this was discontinued, when the furnace was put in blast. The charcoal blast-furnace, which was built in 1853, continued in blast till 1874, and it is estimated produced about forty-five thousand tons of pig-iron. Sir William Fairbairn speaks of the Londonderry iron as follows:‖

"The specular ore of the Acadian Mines, Nova Scotia, is said by Dr. Ure, to be a nearly pure peroxide of iron. . . . . The Acadian ores are situated in the neighborhood of large tracts of forests capable of supplying almost any quantity of charcoal for the manufacture of the superior qualities of iron and steel. Several specimens of iron from these mines have been submitted to direct experiment, and the results prove its high powers of resistance to strain, its ductility, and adaptation to all those processes by which the finest descriptions of iron and steel are manufactured.

"The difficulties which the Government have had to encounter

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* *Can. Geol. Survey Report*, 1874. Harrington, "Iron Ores."

† *Mines of Nova Scotia*, Gilpin, 1880.

‡ *Natural History Society*, Montreal, Vol. VII, p. 134.

§ *Acadian Geology*, Dawson, p. 582.

‖ *Iron, its History, Properties and Processes of Manufacture*, by William Fairbairn, F.R.S., F.G.S., p. 34.

during the last two years, in obtaining a sufficiently strong metal for artillery are likely to be removed by the use of Acadian pig-iron. Large quantities have been purchased by the War Office, and experiments are now in process under the direction of Lieutenant-Colonel Wilmot, Inspector of Artillery, and the writer, which seem calculated to establish the superiority of this metal for casting every description of heavy ordnance."

The site chosen by Mr. Archibald for the furnace and buildings was on the west branch of the Great Village River, immediately on the ore-deposits of that place. The nearest shipping point by water was at Great Village, some six miles away, and there were no means of communication except by teams. The importance of obtaining railway-communication was very great; so, when the Intercolonial Railway surveys were being made in 1864, Mr. John Livesey, who at that time represented the iron-works, exerted himself to get the railway as close as possible to the works.

Mr. Sandford Fleming, in his *History of the Intercolonial Railway*, says: "Mr. Livesey continually urged, both privately and officially, the importance of locating the railway on a route passing close to the iron-mines in which he was interested. . . . . The working season of 1865 was occupied in surveys. Every pass across the Cobequid Mountains, within the limit of the iron-district, was examined, and every effort made to secure a practical line near the iron works."

The Chief Engineer, Mr. Fleming, favored a line which did not run close to the works, and a discussion was carried on very warmly in Nova Scotia. The matter had finally to be referred to Ottawa, as in 1867 the provinces were confederated, and the Dominion came into existence.

Six different routes had been surveyed; and one of them, a sort of compromise, was finally adopted by the Dominion Government, and by a letter of the 6th November, 1868, the Chief Engineer was instructed to carry it out. Mr. Fleming goes on to say: "Thus the controversy was ended; and hence arose that gigantic and conspicuous sweep, which the railway-traveller will observe on the southern flank of the Cobequid Mountains, where the line describes nearly half a complete circle. So marked is this feature in the location, that the popular voice has applied to it the term, 'The Grecian Bend,' which possibly may be retained so long as the railway endures."

In October, 1873, the Acadia iron-mines were purchased b the Steel Company of Canada (Limited). In the previous year, Dr. A.

R. C. Selwyn, F. G. S., Director of the Geological Survey of Canada,* made a report on the Acadia iron-ore deposits.

The property consisted of 55 square miles of freehold-land, with all the mines and minerals. Dr. Siemens was the chairman of the company, and they proposed to work the main bulk of the ore by Siemens' direct process for the production of iron and steel. Two of the furnaces were rotators, specially designed for the work, 9 feet in diameter and 8 feet long, and were revolved by machinery, others were afterwards built 7 feet in diameter by 10 feet long.

About two and a half million dollars were spent in opening the mines, building tramways, furnaces, a rolling-mill, coke-ovens, etc., and in 1877 over 10,000 tons of pig-iron was produced, and the amount has been increased every year since.

Although the works were built with a view to the manufacture of both cast and spring-steel of the very finest description, this was not carried on for any length of time, and a large portion of the plant has since been discarded. Probably the sudden stoppage of the proposed construction of the Canadian Pacific Railway by Sir Hugh Allan, made a change in the product necessary, and the company never made any steel rails, but turned its attention to bar-iron, nail-plate, car-axles, car-wheels, castings and pig-iron. The brand is "Siemens," and the quality of their products is the very best.

Like all pioneer enterprises, they have had a great many difficulties to contend against, and it is much to be regretted that the company is now in liquidation, and its property is for sale. They advertise that their works consist of "two modern blast-furnace, 19 feet bosh, 65 feet high, with Siemens, Cowper & Ford's patent hot-blast stoves,† spacious stock-houses, and all necessary tracks and rolling stock, 67 bee-hive coke ovens, puddling forge and rolling mill, including car-axle plant, capable of manufacturing 10,000 tons of iron per annum, a car-wheel foundry of a capacity of 100 wheels per day, machine, pattern and carpenters' shops, dwellings, etc. Also the Chignecto and St. George Coal Mines, situated near Maccan, Cumberland County, N.S., together with 1500 acres of land well timbered. The Chignecto Mine is fully developed, and thoroughly equipped for raising and delivering 400 tons of coal per day."

Halifax Iron-Works.—In addition to the iron-works already men-

* Report of Progress, 1872-3.

† These stoves were the first set of firebrick stoves erected on the continent of North America. Swank, p. 327.

tioned, there is a rolling mill at Halifax, where scrap-iron is worked up into nail plate, ships' knees, etc., by the Halifax Rolling-Mill Company.

Forge and Steel-Works in Pictou County.—The Nova Scotia Forge Company, at Trenton, near Glasgow, in the County of Pictou, are situated on the East river bank; they have very complete appliances for forging all classes of work out of scrap-iron; they make ships' knees, steamship and mill-shafts, and specially car-axles. Probably more work is turned out from this shop than from any other forge in Canada.

The Nova Scotia Steel Company's Works adjoin the forge. These steel-works are the only ones in the Dominion; they were completed in 1883, their first cast being made on the 25th July of that year. One 15 ton open hearth Siemens' furnace, gas-producers, a reheating-furnace, with two trains of rolls, one 16 and the other 28-inch, complete the steel-making plant. The mill is driven by a reversible steam-engine of the latest type, and steam is furnished by seven multitubular boilers.

The works have an annual capacity of 9000 tons, and produce plates, bar, spring and machinery steel, from hematite pig and steel scrap. Everything is very compact and complete about the works, which are well situated on the banks of the East river, a short distance below Smelt brook, between the river and the line of the Intercolonial (Pictou and Truro Branch) Railway. Vessels can unload direct into the company's premises, and the railway has a siding into the works, so that shipping facilities by rail or water are equally good. The Pictou Coal Field being only a mile or two distant, fuel is very cheap. A nail-factory for cutting steel nails has recently been established in connection with the works.